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Ag Weather Outlook

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Introduction

The increased demand for commodities does not change production risk but it does raise the stakes, and it does directly impact marketing risk. Tie demand together with increased weather risk to production, and the benefits of good management and marketing decisions are greatly multiplied. There is no sure way to forecast how weather during the next 10 months will differ from usual, but some indicators do exist. Sea surface temperatures in the equatorial Pacific have been not unlike those observed in 1987. Midwest weather extremes throughout 2007 have been notable as is often the case before major drought events. The well-documented 19-year climate cycle has entered the high risk phase, and responses associated with a general warming trend compound the risk.

Production Risk

Production risk varies from farm to farm, if not from field to field. Every farmer would do well to chart the historical yields of each field. Although a 30-year trend graph may not be possible, the yield of the crop of interest over even a few seasons is of value. The chart is important because it is not very instructive to compare actual yields over a period of years. Figure 1 charts the U.S. Corn yield for the past 30 years. The clear trend to higher yields renders it difficult to evaluate overall crop performance by direct comparison of yields over a period of years. The poorest yields since 1996 exceed the record-setting high yield of 1986. It is important to compare your trend with the county, district, state, and national trends to establish whether you are leading or lagging in the technology of farming. Weather or other factors can single out your farm now and then but, if your yield trend lags the county, state, or nation, the variation is likely caused by factors you can manage.

Crop producers should anticipate that the national yield will differ from trend by some percentage of the trend according to the variability seen in the past 30 years. However, yield tends to exceed the trend slightly more often than it falls below trend (54% of all years the yield exceeds trend). Most state yield histories have greater variability than does the nation, and local yields are likely the most variable of all. Knowing the variability at farm and market levels is essential to management of production and marketing risk. A simple production risk analysis is the ratio of above trend years to below trend years. The second level of analysis is to establish the distribution of probability of exceeding the trend by 10% or more, by less than 10%, underachieve by less than 10%, underachieve by more than 10%. The 100 year probability results for U.S. corn yield are: 23%, 31%, 29%, and 17%, respectively.

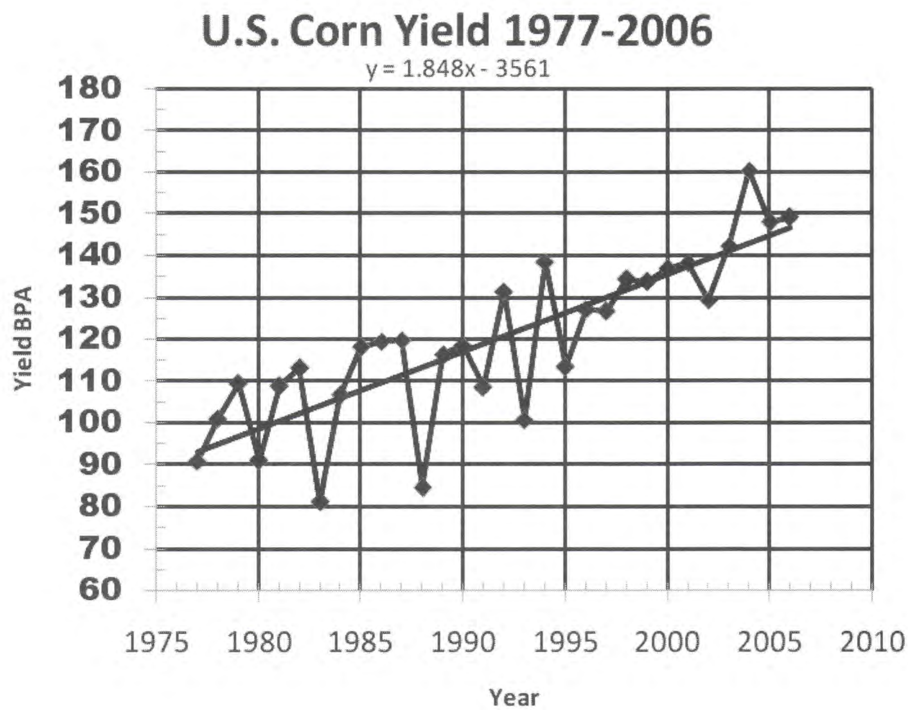

Figure 1 U.S. Corn Yield from 1977-2006. The USDA trend is a linear trend defined by the yields of the past 30 years. Graphs may be created by a spreadsheet program used in personal computers (Microsoft Excel). The equation of the trend line is used to compute the trend for the subsequent year (but is not reliable to compute trend for an extended period of time as historical yields are not strictly linear and errors can be significant when extended beyond two years). Data from www.nass.usda.gov

If my marketing plan followed the U.S. production risk, for example, as my basic strategy I could sell 23% of my trend yield before planting. Suppose that my farm performs 2% better than the U.S. probabilities; then I may sell 25% of my farm's trend yield before planting; if my farm tended to under-perform the national risk by 2%, I would sell 21% early as my basic plan. Of course in any eventuality I would not advance contract any crop unless I could guarantee delivery. I could then contract part of 60% of my expected yield whenever the price between planting and harvest exceeds the anticipated harvest price.

Using income insurance: If you insure your yield, sell it on the futures market and have a crop failure, will the insurance pay you the bushels (payment in kind), or the cash value of the bushels you insured at the rate in place in February, or something else? Be sure you know what will happen in every eventuality; then consider both your production and marketing options.

Corn price volatility set a 28-year record annual high in 2006 and by October 2007 it appeared that 2007 would exceed it. The previous record was established in the most recent Corn Belt-wide drought year, 1988. June and July are historically the months of greatest price volatility for corn and are the months of greatest apparent anxiety concerning likely weather impact on crops. The record month for price volatility in the Chicago market was June 1988 (Table 1), when groups that had no experience with the analysis of weather impacts on corn yield released harvest forecasts of 70%+ crop loss and experienced groups put the loss at near 30% (the reality turned out to be a national yield that was 28.2% below the trend). It is safe to say that weather concerns significantly influence price volatility. Weekly corn price at Chicago reached a peak near the end of February of 2007 (Fig. 2); a like high was achieved in late June. These were each occasions when the SOI indicator of the status of the El Nino / La Nina event was widely seen as suddenly moving toward the higher risk La Nina condition (Fig. 3). The volatility was highest in October 2006 (Table 1) when the SOI initially indicated that the favorable El Nino conditions were not likely to persist (see 90-day SOI graph, Fig. 3). January and May 2007 were months of greater price volatility and each corresponded with short term spikes in the movement of the SOI. It appears likely that volatility will remain high during the next 10 months and perhaps exceed the peak that occurred at the apex of the 1988 drought.

Table 1 "Volatility is measurement of the change in price over a given period. It is often expressed as a percentage and computed as the annualized standard deviation of the percentage change in daily price." CBT 18 October 2007 http://www.cbot.com/cbot/pub/page/0,3181,1237,00.html

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Average
1980	24.2	8.2	13.0	15.5	14.8	6.3	24.8	21.7	15.0	17.4	17.5	24.5	16.9
1981	16.2	16.7	12.2	13.2	16.8	15.2	22.3	21.1	15.0	13.8	10.6	21.2	16.2
1982	10.3	8.0	10.0	9.1	8.0	9.5	9.8	21.7	18.4	18.6	20.6	12.2	13.2
1983	12.8	16.8	17.2	15.1	16.4	9.6	19.1	28.3	25.2	20.0	15.1	14.5	17.5
1984	17.6	14.4	8.6	15.5	9.4	10.2	19.6	21.1	13.3	10.3	9.3	11.2	13.4
1985	7.0	7.7	6.8	6.0	5.6	8.8	14.5	14.6	18.9	17.9	13.2	7.0	10.7
1986	11.3	11.3	11.7	15.9	17.7	17.3	26.5	18.5	21.2	25.3	14.1	13.6	17.0
1987	20.8	23.7	17.0	18.7	30.5	35.9	23.8	24.4	19.4	21.1	12.1	14.3	21.8
1988	15.6	15.9	11.7	9.7	26.6	56.0	54.8	35.7	18.6	20.2	19.9	13.5	24.8
1989	22.3	13.6	17.1	16.8	13.3	23.0	33.1	12.7	17.5	17.9	12.3	6.1	18.1
1990	8.1	7.5	10.6	10.1	14.9	18.8	19.0	19.0	19.3	17.2	19.7	10.6	14.7
1991	10.8	8.8	14.5	13.7	13.2	21.4	321	32.1	12.2	14.2	12.9	11.2	16.4
1992	11.0	17.1	9.4	13.9	19.8	22.2	15.3	17.9	15.7	11.7	17.5	6.7	14.8
1993	9.1	5.7	8.2	13.5	13.5	14.6	24.4	14.9	16.8	17.3	19.9	9.6	13.9
1994	16.4	13.6	17.5	18.0	27.1	33.4	22.7	10.8	12.1	12.1	8.7	11.1	17.1
1995	7.9	7.5	7.8	9.9	15.3	24.6	17.4	12.7	17.3	12.6	13.7	12.0	13.2
1996	20.5	14.5	14.8	36.0	26.2	39.4	33.5	23.6	19.1	15.4	15.0	12.2	22.5
1997	13.4	15.7	23..6	21.0	19.6	17.8	32.6	33.9	16.9	25.1	20.5	15.1	21.3
1998	21.9	11.6	19.9	17.9	21.4	31.3	25.2	18.5	18.9	22.2	14.8	11.4	19.6
1999	16.4	16.8	20.5	17.3	17.9	19.1	39.9	30.4	16.0	13.4	14.9	13.9	19.7
2000	22.4	14.4	25.6	16.8	26..0	28.8	20.4	16.2	18.5	17.4	17.0	15.7	19.9
2001	17.9	12.1	19.2	20.8	21.3	16.6	41.6	19.1	17.3	15.0	21.4	11.2	19.4
2002	12.0	13.1	11.6	11.4	23.2	20.2	42.1	24.7	28.0	19.2	16.7	13.0	19.6
2003	20.2	11.4	18.5	12.5	22.6	19.7	16.6	25.4	22.8	28.6	25.2	18.3	20.1
2004	26.0	17.9	23.6	26.3	27.6	29.9	20.4	23.4	15.1	18.0	15.5	16.7	21.7
2005	20.1	20.9	22.6	20.1	25.0	33.8	42.2	22.4	16.0	10.45	9.51	19.5	21.9
2006	19.1	23.1	30.7	19.8	31.3	28.8	26.7	30.2	39.5	43.5	26.9	26.3	28.8
2007	38.1	27.9	23.0	36.8	42.0	38.1	30.1	27.3					32.9
Mean	16.8	14.1	16.0	16.8	20.4	23.2	26.8	22.7	18.7	18.4	16.1	13.8	18.6
High	38.1	27.9	30.7	36.8	42.0	56.0	54.8	35.7	39.5	43.5	26.9	26.3	56.0
Low	7.0	5.7	6.8	6.0	5.6	6.3	9.8	10.8	12.1	10.3	8.7	6.1	5.6

Figure 2. Weekly corn prices at Chicago. The changing price of corn is not directly caused by any environmental factor, but perceptions of environmental conditions and impacts do have an influence. Source: http://www.cbt.com

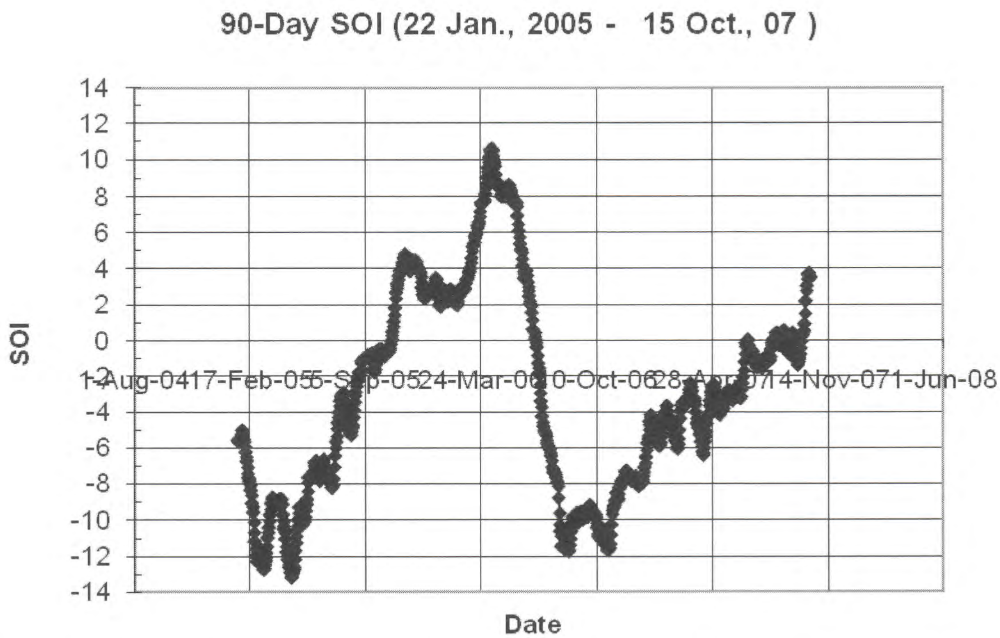

Figure 3. The atmospheric pressure difference between northern Australia (Darwin) and the central Pacific (Tahiti) constitutes the Southern Oscillation Index (SOI) that has been shown to be directly related to the "El Nino" weather pattern and to direct influences on Midwest weather conditions. Data from http://www.longpaddock.qld.gov.au

Factors influencing extreme weather

Although the El Nino / La Nina cycle is the major long-term weather factor influencing the commodity market, it was not the factor that had primary influence on the erratic weather in the U.S. Corn Belt and elsewhere in the world during 2006. The 6-week Midwest moisture cycle that occasionally initiates and sometimes persists for more than a year was more significant. The configuration of the semi-permanent pressure centers that develop seasonally at high latitudes together with the configuration of the polar air flow that gives rise to the well-known "jet stream winds" over North America, the little understood but historically significant 19- and 60-year moisture cycles, and most of all the current episode of "global warming" delivered the apparent anomalies during the past 18 months. There is some historical indication that such anomalies tend to culminate in widespread Midwest drought events.

The Midwest experienced pockets of extreme dryness during the 2007 growing season and wide-spread areas of excessive moisture that recurred twice or three times during the production season. There is a climate station in every county of Iowa. Although it is not uncommon for heavy rain events to totally miss weather stations, the stations' records do give an idea of changes in the climate. During the first 10 months of 2007, a 50+ year record of heavy rainfall events was set (with 8) for Iowa (Fig. 4). The previous record of 6 was set in 1977, a year of serious district drought (drought in central Iowa). The following year was generally favorable for corn yield in the Midwest.

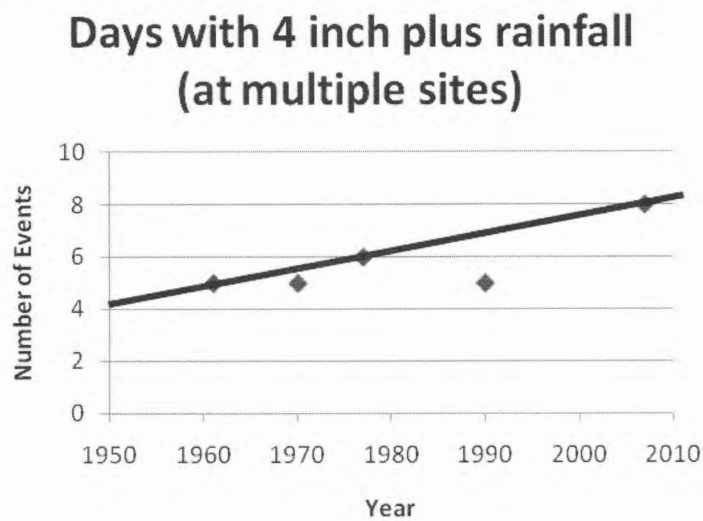

Figure 4 Years when multiple coop weather stations in Iowa recorded rain in excess of 2 inches during a 24-hour period. Eight separate events of 4 inch plus rainfall at multiple sites (2 or more) occurred by mid-October of 2007. The increase in number of heavy storm events is not sufficient to establish a trend but is consistent with expectations during episodes of global warming. Numerous occurrences of 4 or fewer events not shown. Graphic provided by Daryl Herzmann, www.mesonet.agron.iastate.edu

Erratic weather is typified by the simultaneous occurrence of drought and excess precipitation often in the same locality over a single season. Extremes of temperature are also typical. Three or more conditions, independently or in combination, result in abnormally erratic weather in the Midwest. Some years ago it became apparent that the primary manifestation of global warming was increasingly erratic weather (rather than gradual increases of mean conditions). Year-by-year variations in the impact of erratic conditions are attributed to the 19-year climate cycle and to La Nina.

There is some confusion concerning the delimitating of El Nino and La Nina. It has rightly been discerned that the temperature of the sea surface is the driving power of both events. However, sea surface temperature does not directly impact Midwest weather; the atmospheric pressure (SOI) variously associated with the El Nino/La Nina is directly correlated with trends in the U.S. Corn Belt. Although weather patterns typical of La Nina can develop at any time, they are statistically likely when the 5-month SOI averages +0.80 (+8.0 by the Australian system). Experience has taught us that when the moving 90-day average of the SOI reaches the +0.80 threshold, the probability that the 5-month value will qualify reaches a significant level and may be used as a factor in management of weather risk. The trend toward La Nina (Fig. 3) has been interpreted as likely to reach the level of significance early in 2008 and weather conditions typical of a La Nina event are forecast through spring of 2008 according to the National Weather Service (http://www.cpc.ncep.noaa.gov/products/predictions/90day/). This includes above usual precipitation in and near Montana and in the upper Ohio River valley. Also a greater than usual number of very cold episodes may be expected in winter and spring although the average temperature may average above the norm.

The 19-year cycle is well established and is clearly evident in the past 800 years of tree growth as recorded in annual growth rings. As with all cyclic weather events, the actual time (year) of "best" or of "worst" weather for plant growth is at best predicted with a plus or minus 2 year window. This, however, is of sufficient accuracy to be of value in the management of weather risk. It is not of sufficient accuracy to forecast that a specific year will have poor yields. The first known published accounts of the 18- or 19-year dry-wet cycle is in the 1884 and later editions of Benner's Prophecies' (http://www.archive.org/details/bennersprophecie00bennuoft). Several interpretations of the cycle have appeared over the past 60 years. Table 2 has proven to be the most useful for predictive risk management. During the period when the probability of wide-spread drought is double, it is reasonable to adjust risk management programs to the level of the increased risk. Considering that only the 19-year cycle is a major factor would change the level of risk probabilities presented initially to show a drought probability of 24% rather than the 17% that is the 100-year average risk of drought.

Risk factors do combine, so the probability of drought resulting from the 19-year cycle and that contributed by La Nina (should such become a factor) becomes 31%. This risk value would assume normal planting date and normal subsoil moisture at planting time. If either differs from normal, the risk will be further adjusted as it would with other possible factors. On the side of not contributing to greater drought risk; judging only from conditions up to mid-October of 2007, the subsoil moisture is likely to recover to near normal by spring. Contributing some to greater risk is the 2007 drought condition of Georgia and South Carolina. Although widespread drought does not always follow drought in the SE U.S., the record shows that 16 of the previous 17 major Corn Belt droughts were preceded by drought in the South Carolina area. This initial assessment does identify an above normal chance of a short corn crop nationally in 2008 but is not sufficient to forecast such. Often it is apparent by December if SOI conditions will become La Nina, neutral, or El Nino during the early growing season, making a yield forecast justifiable.

Table 2. 19-Year Drought Cycle. Weather Cycle Calendar by Louis M. Thompson, 1989 (revised 9/24/2006). Adapted by E. Taylor 9/27/2006.

	1		1882	1900	1919[b]	1937[b]	1956	1974[e]	1993[f]	
	2		1883	1901[d]	1920[a]	1938	1957	1975	1994[a]	
	3		1884[b]	1902	1921	1939	1958	1976	1995[c]	
	4	1866	1885[b]	1903	1922	1940	1959	1977	1996	
Wet phase	5	1867	1886	1904	1923	1941	1960	1978[b]	1997	18.5°
	6	1868	1887[c]	1905[a]	1924[c]	1942[a]	1961	1979[a]	1998	
	7	1869[c]	1888[b]	1906[a]	1925	1943	1962	1980[c]	1999	
	8	1870[a]	1889[a]	1907	1926	1944	1963	1981	2000	
	9	1871[b]	1890[c]	1908	1927[d]	1945	1964[c]	1982[b]	2001	
	10	1872	1891	1909	1928	1946	1965[b]	1983[d]	2002[c]	
	11	1873[c]	1892	1910	1929	1947[d]	1966	1984	2003	
	12	1874[c]	1893	1911[c]	1930[d]	1948[a]	1967[a]	1985[b]	2004[a]	
	13	1875	1894[d]	1912	1931	1949	1968	1986[b]	2005	
Dry Phase	14	1876	1895	1913[d]	1932[b]	1950	1969[a]	1987[b]	2006	28.5°
	15	1877	1896	1914	1933	1951[c]	1970[c]	1988[d]		
	16	1878	1897	1915	1934[d]	1952	1971[b]	1989		
	17	1879	1898	1916[c]	1935	1953	1972[a]	1990		
	18	1880	1899	1917	1936[d]	1954[d]	1973[b]	1991[c]		
	19	1881[d]		1918[c]		1955[d]		1992+		

Lunar declination reaches the minimum (18.5°) during the wet phase and the maximum (28.5°) in the dry phase. Some evidence relates weather trends to lunar gravitational influence.

[a] Very High Yield	2004
[b] High Yield	1937
[c] Low Yield	1995
[d] Very Low Yield (drought)	1988
[e] Very Low Yield (combined)	1974 - Very wet spring, summer drought, early freeze
[f] Very Low Yield (flood)	1993
Low yield years in "wet" phase	10
Low yield years in "dry" phase	20
Good yield years in "wet" phase	16
Good yield years in "dry" phase	14

The chance of a "good" year is about the same in either phase. (a, b,)

The chance of a "poor" crop doubles during the "dry" phase. (c,d,e,f)

The average is 4 good and 4 bad crop years in each 18-19 year cycle.